

*** CoCoPRO! RS232 Pak Documentation ***

Introduction

The **CoCoPRO RS232 Pak** is an add-on card for your Color Computer 1, 2, or 3. It provides a "hardware 6551 ACIA chip-based" serial RS232 port for use with most telecommunications software for the CoCo. It is designed to be used with EITHER a Tandy Multipak Interface, Howard Medical Slot Pak, OR with a Y cable. It functions quite similarly to the Disto "stand alone" RS232 pak, the Orion RS232 pak, and the (now discontinued) Tandy RS232 pak and PBJ RS232 pak.

It is our expectation that the vast majority of these devices will be used with "terminal emulator" programs for connecting to information services such as the Delphi CoCo SIG and local bulletin board services. We also would expect that most purchasers of this equipment will be using them with external Hayes-compatible modems or with null modem cables. In such useage we would expect few problems. Some of you using this product may have NON Hayes-compatible modems or wish to use it wit bulletin board systems that you are running on your computer. You may wish to refer to the technical information below if you run into problems.

Technical Information

Similarities to Other RS232 Paks:

This device uses the SAME 6551 ACIA chip that is found in most other RS232 paks. The four hardware ports of that chip are addressed to the SAME location in the CoCo's memory (\$FF68 thru \$FF6B) as those used by the original Tandy RS232 pak, the first port of the PBJ Dual SP Pak, the Disto (stand alone) RS232 pak, and the Orion RS232 paks. The interrupt pin of the 6551 in this pak is hooked to a 4.7K pullup resistor and connected to the *CART pin of the CoCo system bus. In this respect the interrupt circuitry is also identical to the various other RS232 paks mentioned above. Thus, most Disk Extended Color Basic and OS9 programs designed for use with the "Tandy RS-232 pak or equivalent" should function properly with this hardware.

Differences from Other RS232 Paks:

Most of the ways in which this pack differs from other RS232 paks relate to the manner in which it generates RS232-voltage signals and the number of such signals supported.

RS232 Voltage Levels:

The **CoCoPRO! RS232 Pak** uses a single MAX232 or Intersil 1CL232 chip to accomplish level conversion. The desirable aspect of this is that the **CoCoPRO! RS232 Pak** can function properly with ONLY +5 volts supplied to it. In this respect it is similar to the Tandy RS232 pak (though the Tandy RS232 pak accomplishes the same effect differently, by using a stand alone solid state voltage converter module in conjunction with 1488 and 1489 level converter chips) and similar to some models of Orion RS232 pak. This ability to produce RS232 voltage levels from a single +5 volt supply allows the **CoCoPRO! RS232 Pak** to work properly when used with a Y cable or with a Howard Medical Slot Pak, as is NOT the case for the Disto stand alone RS232 pak or some less expensive models of the Orion RS232 pak. The RS232 voltage levels generated are around + and - 9 volts, which are quite respectable levels for communication along relatively long (25 feet and more) cables, unlike the wimpy and marginal + and - 4 volts that the PBJ Dual SP Pak produced.

The level converter chip used in the **CoCoPRO! RS232 Pak** provides for two RS232 to TTL level and two TTL level to RS232 signal conversions. Thus, the **CoCoPRO! RS232 Pak** as supplied supports only FOUR of the common RS232 signal lines, plus ground. Those four lines are: RxD, TxD, CD, and DTR. The **CoCoPRO! RS232 Pak**, unlike the Tandy RS232 pak, does NOT support the DSR, RTS, or CTS lines.

In some cases you may be using this device with modems or other devices that require some signal on one or more of those unsupported lines. In most such cases, merely pulling up the required handshake line in the alien device by tying it to DTR coming from the CoCoPRO! RS232 Pak will cure matters. In other cases, you may need to experiment a bit. Relatively heavy duty hardware hackers will notice if they open up this device that there are provisions on the level conversion circuit board for a hardware tinkerer to add two additional 16 pin DIP chips. These may facilitate the dedicated hardware tinkerer in adding support for the other handshake lines of the 6551 chip, though the designers feel that this will be necessary in only some of the most specialized applications, and the vast majority of users will not have need of such modifications.

Speed of the 6551 chip:

Some of the CoCoPRO! RS232 paks use a 6551 ACIA chip, and others use a 6551A ACIA chip. The 6551 chip is rated for operation at up to 1 MHz, and the 6551A chip is rated for operation at up to 2MHz. However, experience with the Tandy RS232 pak (which uses the 1MHz 6551 chip) has shown that the vast majority of such 1MHz rated chips function perfectly properly with a CoCo 3 running OS9 or other 2 MHz processor-speed applications. A VERY SMALL MINORITY of 6551 chips do cause problems when used with OS9 and other 2MHz software. The problem typically shows itself as a "lockup" during telecommunications applications. Now, there are a number of other possible sources of the "lockup during telcom" problem. Before you decide your problem is due to a "slow" 6551 chip, first (a) "strap the CART interrupt lines" on your Multipak. If this does not cure the problem, do the "Diode Interrupt Fix" inside the Color Computer 3 that I (Marty Goodman) described in a past issue of Rainbow Magazine. If the lockup problem STILL does not go away, and if your pak has a 6551 (not 6551A) chip in it, you may want to consider finding a hardware tinkerer who will remove the soldered-in 6551 chip and replace it with a socket, and install a 6551A chip.

Carrier Detect ideosyncrasy:

The 6551 chip's receiver will not function unless it has a positive signal on its carrier detect line. Thus, when using this device with a modem, if you want commands to the modem to be echoed back to the terminal program before you have gone on line, you must set a DIP switch or a software (non volatile RAM) setting on your modem that causes the carrier detect line from the modem to be always in "carrier received" state. Alternatively, you can try not hooking pin 8 of the CoCoPRO! RS232 pak to the modem at all, and instead jumpering it to pin 20 on the RS232 pak.

Pin Out

<u>DB-25</u>	<u>Function</u>
2	TxD Transmit data (data from RS-232 pak TO modem)
3	RxD Receive data (data from modem TO RS-232 pak)
7	signal ground
8	CD Carrier Detect
20	DTR Data Terminal Ready

Note again that only 4 signal lines and ground are supported.

Suggested Cabling

To modem:

Set modem so that "carrier detect is forced high" using DIP switches on the modem or software commands. Then connect the CoCoPRO! RS232 pak to the modem using a "straight thru" 25 wire DB25 to DB25 cable. Alternatively, you can use a DB 25 to DB 25 cable that supports as few as five lines (pins 2,3,7,8, and 20). If you cannot make your modem force carrier detect high, an alternative is to make up a special cable that forces CD high via the DTR line of the pak. Here's how: Make a cable that sends pins 2,3,7, and 20 straight thru between modem and CoCoPRO! RS232 pak. Then, on the CoCoPRO! RS232 pak side of the cable, short pin 20 to pin 8. This uses the DTR of the CoCoPRO! RS232 pak to force the carrier detect of the RS232 pak high. Try using this last cable if you are having trouble making your modem respond.

Cable to Force CD High: (for use with most modems)

CoCoPRO!	modem
DB25	DB25
2	2
3	3
7	7
20,8	20

(pin 8 shorted to pin 20 on CoCoPRO! pack side of cable)

Null Modem cable to IBM PC or to Tandy RS232 pak:

CoCoPRO!	IBM or Tandy RS232
DB25	DB25
2	3
3	2
7	7
↓	↓
short pin 8 to pin 20	short pins 6,8, and 20 together, also short pin 4 to pin 5

Most AT compatibles and many lap PC compatibles use a DB 9 connector on their serial port. Here's the pin out for a null modem cable for those kind of IBM style serial ports:

CoCoPRO!	IBM
DB25	DB9
2	2
3	3
7	5
↓	↓
short pin 8 to pin 20	short pins 6,1, and 4 together to pin 20 also short pin 8 to pin 7

Port Address Notes:

The CoCoPRO! RS232 pak, as noted above, is addressed for your convenience to the standard CoCo hardware RS232 ports of \$FF68 thru \$FF6B. OS9 users sometimes wish to use TWO RS232 paks, with one of them addressed to the ports at \$FF6B thru \$FF6F. It is extremely easy to convert the CoCoPRO! RS232 pak's addresses to that alternative space. Simply remove the jumper wire soldered to pin 1 of the 74LS04 chip, and solder it to pin 2 of that chip instead. Note that pin 2 already HAS a wire soldered to it. BOTH wires are now to be soldered to pin 2. This quick and simple change will re-address the CoCoPRO! RS232 pak to the addresses used by the standard secondary hardware RS 232 port under OS9. These addresses (\$FF6B thru \$FF6F) are the same as those used by Tandy's old and worthless Direct Connect Modem Pak.

Technical Reference Documents:

Included with this documentation are the following:

(1) The schematic for the CoCoPRO! RS232 pak. (2) The schematic for the old Tandy Direct Connect Modem Pak (3) The schematic for the old Tandy RS232 pak (4) Some information on the 6551 chip in this pak (5) A listing of the functions of the pins on the CoCo system bus.

Final Note:

Many of you, looking at the CoCoPRO! RS232 pak, will have by now recognised a distinct physical resemblance to Tandy's old and utterly worthless Direct Connect Modem Pak. The fact is that your CoCoPRO! RS232 pak started its "life" as a Tandy DC Modem Pak. However, the worthless 300 baud modem was removed, and a special interface board was installed in its place. Thus, the CoCoPRO! RS232 pak is actually a custom modified DC Modem Pak. Both the special interface board and the routine for modifying the DC Modem Pak, as well as this documentation, are the work of Dr. Marty Goodman, of Rainbow CoCo Consultations and Delphi CoCo SIG fame. Marty just got tired of telling folks to throw away their worthless DC modem paks, and decided to turn those worthless paks into something useful. He teamed up with CoCo vendor Dave Myers of CoCo PRO!, and this pak was the result.

Happy Telecommunications!

Marty Goodman

The CoCoPRO! RS-232 pak and conversion kits are distributed exclusively through:



1334 BYRON AVENUE
YPSILANTI, MI 48198

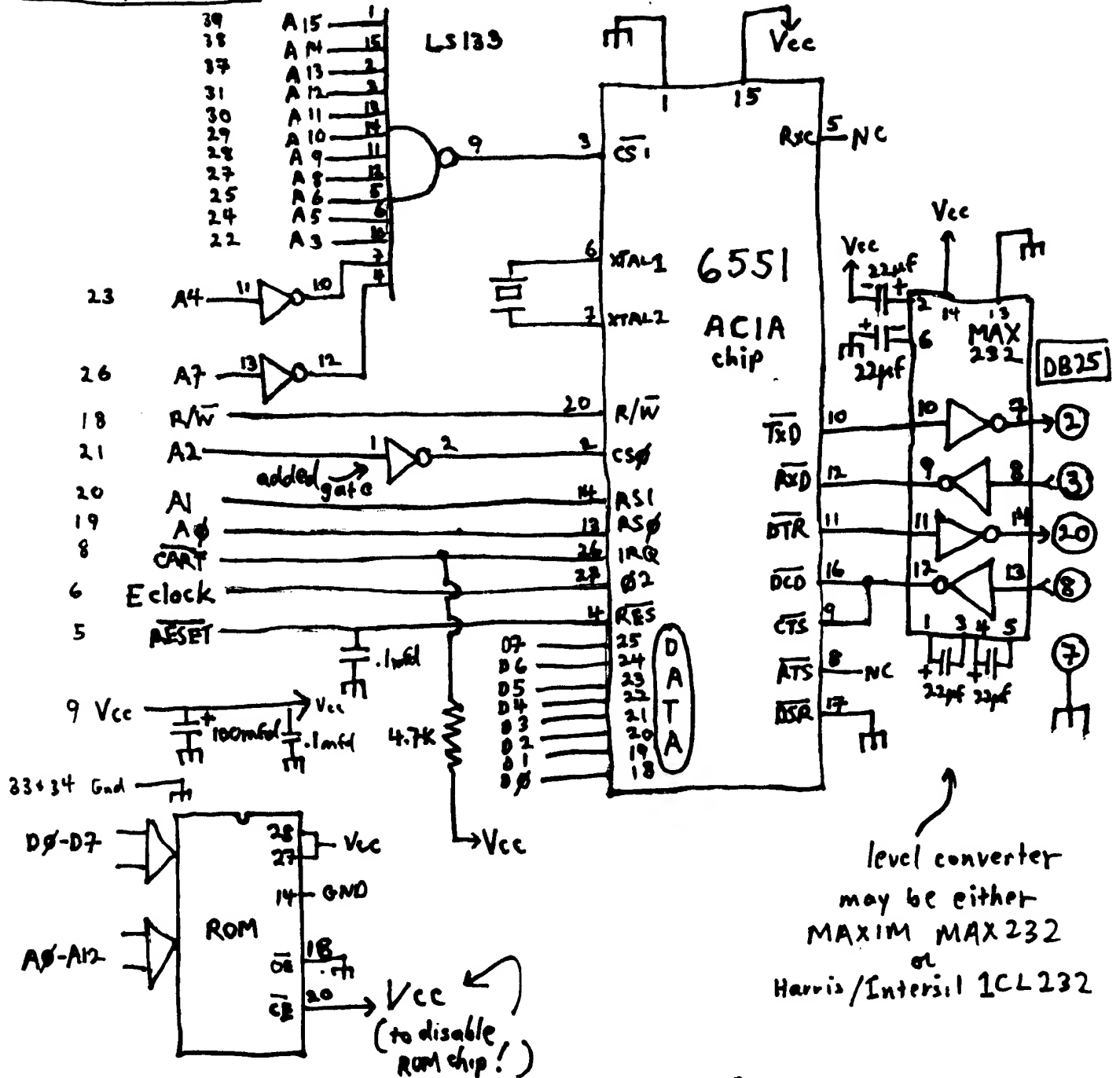
(313) 481-DAVE (3283)

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Schematic for CoCo PRO! RS232 pak

from CoCo Bus

40 pin bus pin numbers



3 → 4

5 → 6

9 → 8

Unused 74LS04 gates

Control register

FF6B

The control register is used to select the desired mode for the 6551. The word length, number of stop bits, and clock controls are all determined by the control register.

Description of 6551 ACIA

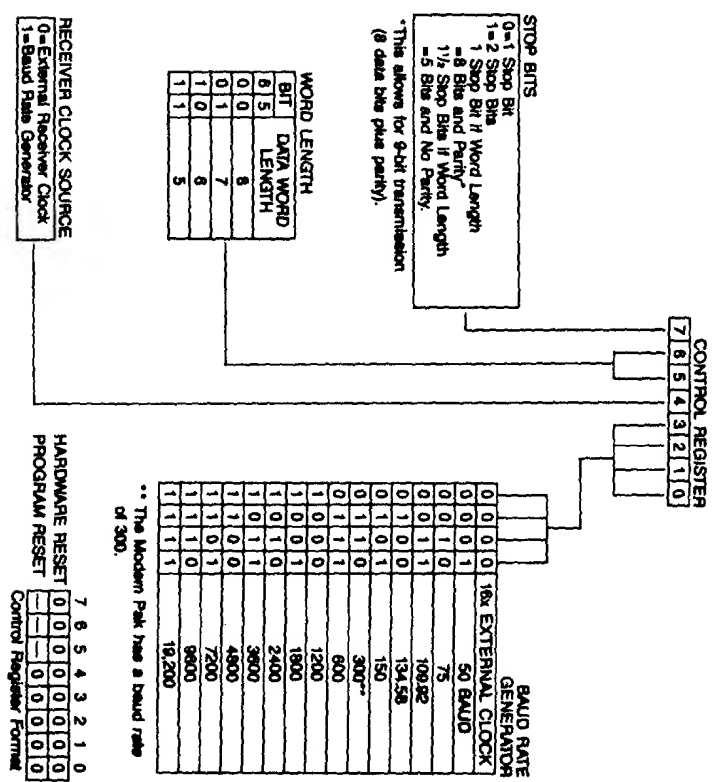
The following information will help you to write a machine-language program for yourself.

The heart of the Modem Pak is the 6551 ACIA (Asynchronous Communication Interface Adapter). It has an on-chip baud rate generator, programmable interrupts and status register for ease of operation, false start bit detection, and echo mode.

This ACIA board is memory mapped to addresses FF6C to FF6F (Hex). The 6551 uses four memory addresses for the following functions.

Coef Pak			
Address	Write	Read	
FF6C	Transmit Data Register	Receiver Data Register	65384
FF6D	Soft Reset	Status Register	65385
FF6E	Command Register		65386
FF6F	Control Register		65387

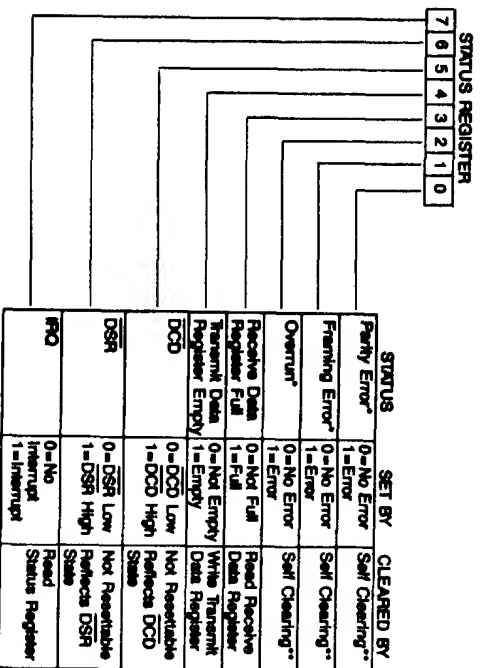
This table shows that only the command and control registers are bi-directional. The soft reset operation clears the 6551 internal registers, but does not cause any data transfer. Therefore, the data written is "don't care." A RES* from the bus will clear all registers in the 6551, while a soft reset will disable interrupts and the transmitter, turn off the echo mode, and clear the overrun error flag only.



Status register

FF69

The status register is used to indicate to the processor the status of various 6551 functions.



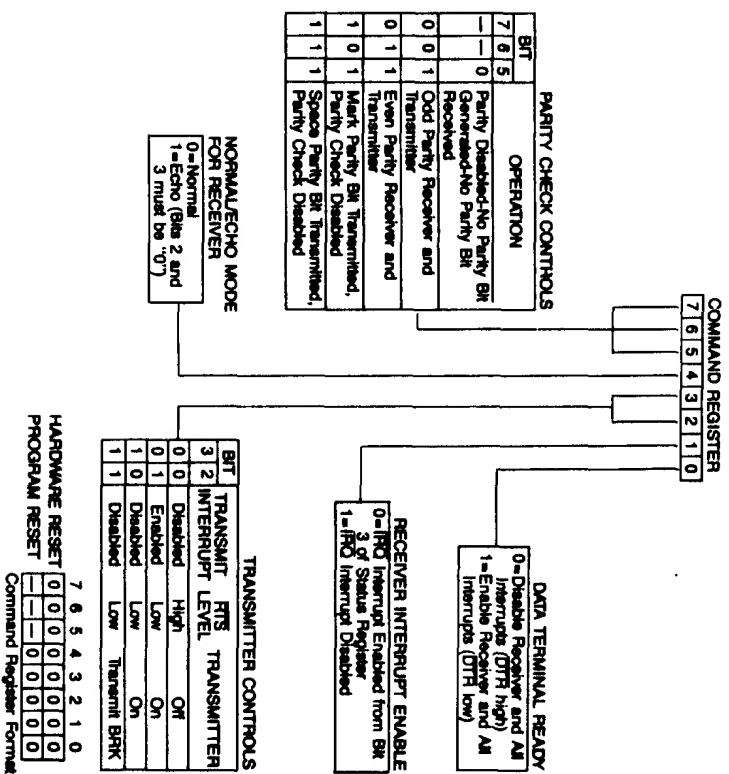
**NO INTERRUPT GENERATED FOR THESE CONDITIONS.
**CLEARED AUTOMATICALLY AFTER A READ OF RDR AND
THE NEXT ERROR FREE RECEIPT OF DATA.

HARDWARE RESET	0	1	0	0	0	0	0	0	0
PROGRAM RESET	0	0	0	0	0	0	0	0	0

Command register

FF6A

The command register is used to control specific transmit/receive functions.

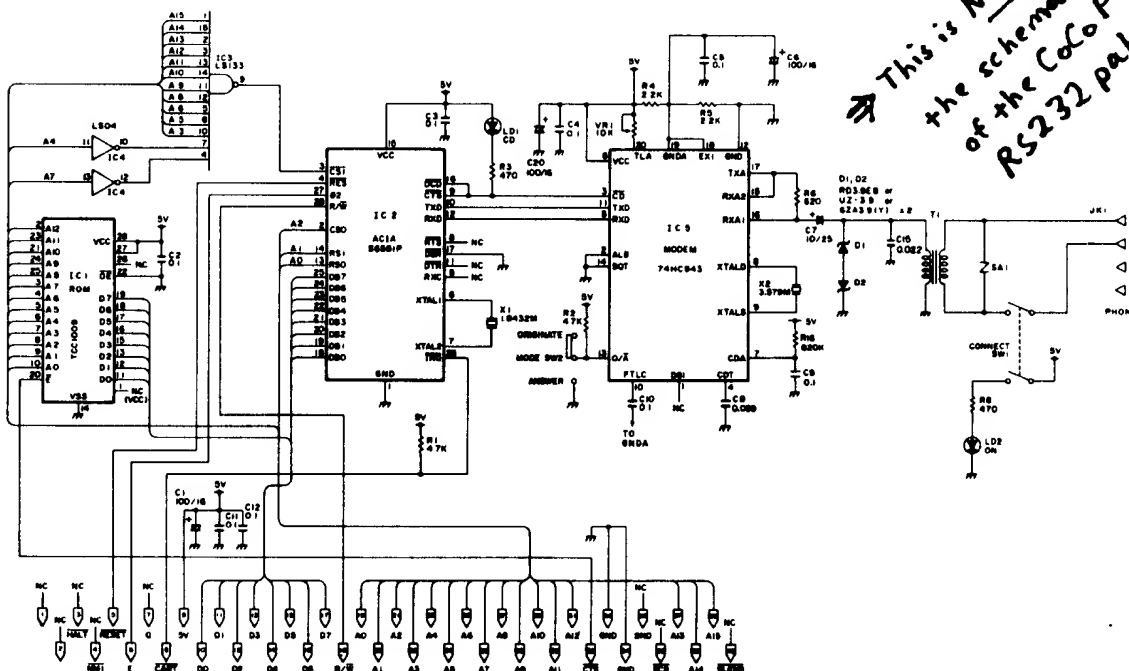


CoCo 2 + CoCo 3 System Bus pin assignments

Pin No.	Signal Name	Description
1	NC	Not Connected
2	NC	Not Connected
3	HALT*	Halt Input to the CPU
4	NMI*	Non-Maskable Interrupt to the CPU
5	RESET*	Main Reset and Power-Up Clear Signal to the System
6	E	Main CPU Clock (0.89MHz)
7	Q	Quadrature Clock Signal which leads E
8	CART*	Interrupt Input for Cartridge Detection
9	+5V	+5V Volts (300 MA)
10	D0	CPU Data Bit 0
11	D1	CPU Data Bit 1
12	D2	CPU Data Bit 2
13	D3	CPU Data Bit 3
14	D4	CPU Data Bit 4
15	D5	CPU Data Bit 5
16	D6	CPU Data Bit 6
17	D7	CPU Data Bit 7
18	RW*	CPU Read/Write Signal
19	A0	CPU Address Bit 0
20	A1	CPU Address Bit 1
21	A2	CPU Address Bit 2
22	A3	CPU Address Bit 3
23	A4	CPU Address Bit 4
24	A5	CPU Address Bit 5
25	A6	CPU Address Bit 6
26	A7	CPU Address Bit 7
27	A8	CPU Address Bit 8
28	A9	CPU Address Bit 9
29	A10	CPU Address Bit 10
30	A11	CPU Address Bit 11
31	A12*	CPU Address Bit 12
32	CTS*	Cartridge Select Signal
33	GND	Signal Ground
34	GND	Signal Ground
35	SND	Sound Input
36	SCS*	Spare Select Signal
37	A13	CPU Address Bit 13
38	A14	CPU Address Bit 14
39	A15	CPU Address Bit 15
40	SLENB*	Input to Disable the Select

Schematic of ORIGINAL Tandy DC Modem Pak (for reference)

→ This is NOT
the schematic
of the CoCo PRG!
RS232 pak



Schematic subject to change without notice. For most accurate schematic (and parts) contact Radio Shack, National Parts Dept., Fort Worth, TX 76101.

(for reference)

⇒ Note: this is NOT

